



MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS
FISHERIES DIVISION
JOB PROGRESS REPORT

STATE: Montana PROJECT NO. F-46-R-1
PROJECT TITLE: Statewide Fisheries Investigations JOB NO. 199
STUDY TITLE: Survey and Inventory of Coldwater Streams STATE DOCUMENTS SECTION
JOB TITLE: Northcentral Montana Trout Stream Investigations
PERIOD COVERED: July 1, 1987 through June 30, 1988 MAY 03 1988

MONTANA STATE LIBRARY
1515 E. 6th AVE
HELENA, MONTANA 59620

ABSTRACT

Trout populations in 22 streams and rivers were inventoried during the report period. Improved flows for trout fisheries of the Marias and Sun River were negotiated. Instream flow information was obtained for 28 streams and rivers. Habitat protection efforts included review of approximately 40 projects proposed under the Stream Protection Act and about 100 projects under the Natural Streambed and Land Preservation Act (SB 310). Snorkel and electrofishing surveys were conducted on several waters to update management files and provide supporting data for instream flow recommendations. Brown trout stocked in Deep Creek do not appear to have survived. A mark-recapture estimate using snorkeling and hook and line indicated a rainbow trout population of 187 fish/mile in the South Fork of the Sun River. Impact statements involving grayling and westslope cutthroat were reviewed. Electrofishing surveys on the Smith River indicated partial recovery of trout populations in the Mid-canyon section but data analysis was not completed. A voluntary creel survey of Smith River anglers was discontinued due to low response rate (6%). Total numbers of rainbow trout in the Craig section of the Missouri River in fall 1987 were similar to past years but numbers of fish longer than 14 inches were unusually low. Rainbow numbers were exceptionally high in the Cascade section due to the presence of unusually large numbers of yearling fish. These fish may have resulted from beaver dam removal to enhance reproductive success in a critical spawning tributary. Numbers of "trophy" rainbow longer than 18 inches appear to have increased significantly in both sections following more restrictive fishing regulations instituted in 1983. Totals of 2775 and 2361 mature adult Missouri River rainbow trout were marked as they passed upstream through traps located near the mouths of Little Prickly Pear Creek and the Dearborn River in spring 1987. A modified mark-recapture procedure was used to estimate that approximately 7500 and 9600 males migrated up these streams respectively. A late April helicopter survey of the lower 42 miles of the Dearborn River revealed about 6000 rainbow trout redds distributed fairly evenly over the lower 30 river miles. A helicopter survey of the mainstem Missouri River between Holter Dam and Cascade revealed relatively limited spawning use by rainbow trout. A total of 2050 anglers were interviewed on the Missouri River between Holter Dam and Ulm during April through September, 1987. Catch rates for rainbow and brown trout were higher than in 1980 and 1981 but harvest rates were substantially lower or unchanged. The recent increase in voluntary "catch and release" trout fishing was correlated with a marked increase in the use of artificial flies and lures. Hatchery rainbow trout flushed from Holter Reservoir concentrated immediately below the dam where they comprised a major portion of angler harvest in spring and early summer.

PLEASE RETURN

OBJECTIVES AND DEGREE OF ATTAINMENT

1. To establish viable trout fisheries in Marias River below Tiber Dam and in the Sun River below Diversion Dam for recreational fishing.
2. To ensure within hydrologic constraints, that flows in streams supporting trout populations do not fall below 1976-86 averages.
3. To maintain summer survival flow of at least 50 cfs in the Smith River at Camp Baker.
4. To maintain streambanks and channels in as natural a condition as possible. (State funded).
5. To maintain undisturbed riparian zones where they currently exist on Smith and Missouri Rivers. (State funded).
6. To maintain water quality at or above 1975-85 average levels as monitored at USGS stations.
7. To maintain habitat and species of special concern at present levels or better in streams affected by resource development activities. (State funded).
8. To ensure that mid-Missouri reservoir operations maintain a minimum flow of 4100 cfs 8 years out 10 in the Missouri River from Holter Dam to Ulm.
9. To evaluate contribution and influence of hatchery rainbow trout flushed from upstream reservoirs on wild trout fishery in Missouri River downstream of Holter Dam.
10. To increase rainbow and brown trout spawning habitat in three tributaries to the Missouri River from Holter Dam to Cascade. (State funded).
11. To maintain trout populations at or above 1984 levels in Tresch Section and 1978 levels in Burleigh Section of Big Spring Creek near Lewistown.
12. To provide 80,000 angler-days annually and average catch rate of 0.4 trout/hour in Missouri River between Holter Dam and Cascade.
13. To evaluate special slot-limit for trout on Smith River and modify regulations to balance angler harvest with population structure if warranted.
14. To maintain trout populations in Regional streams at present levels or higher.

5. To allow harvest of one trout over 12" in USFS streams along Rocky Mountain Front if compatible with stream fishery resources. (State funded).
16. To obtain at least two fishing access sites on the Sun River between the towns of Augusta and Sun River, and one each on the lower Dearborn River and upper Smith River. (State funded).

Progress was made on all federally funded objectives during the report period and is summarized in this report. Progress on objective 11 (Big Spring Creek) was minimal because the workplan specifies electrofishing surveys on alternate, even-numbered years. Also, no fishing regulation changes were proposed for Big Spring Creek during the report period because trout populations remained stable and healthy. Data for some state objectives is included in this report to provide current information for regional streams.

PROCEDURES

An advisory board consisting of personnel from the Bureau of Reclamation, Sportsman's Clubs, County Commissioners, landowners and Department of Fish, Wildlife and Parks was formed to evaluate plans for water manipulation in the Marias River below Tiber Dam. Minimum instream flows for streams in the Smith, Dearborn, Sun, Marias, mainstem Missouri, and Teton River drainages and were determined using Montana's wetted perimeter method (Nelson 1984). Trout populations in the Smith River were surveyed using a fiberglass drift boat equipped with a mobile electrode powered by a 120 volt generator with a rated capacity of 2000 watts. A Fisher Shocker (Model FS 101) was used to convert AC electricity from the generator to straight DC. The Missouri River was electrofished at night using an 18-foot aluminum jet boat and a fiberglass drift boat powered by a small outboard motor. Both boats were equipped with headlights and fixed booms with stainless steel droppers suspended in front of the bow. Electricity from 120 volt generators (either 2000 or 4000 watt) was converted to pulsed DC using Coffelt VVP-2C variable voltage pulsators. Rainbow and brown trout populations in the Smith and Missouri rivers were estimated using the mark-recapture method described by Vincent (1971) and data analysis was conducted using the MDFWP mark-recapture computer program run on an IBM-compatible micro-computer in the Great Falls Regional office. Trout populations in other regional streams were surveyed by electrofishing, snorkeling and hook and line. Creel interviews on the Missouri River were obtained by a roving shore-based clerk working one weekday and two weekend days each week between Holter Dam and Ulm. A portable "black box" equipped with a blacklight was used on the river to examine creel rainbow trout for fluorescent orange pigment marks previously applied to hatchery fish planted in Holter Reservoir.

FINDINGS

Instream Flows

Flow recommendations to improve trout fisheries in the Marias and Sun Rivers are being determined through cooperation with an ongoing research project, F-38-R3 Job II. Flow recommendations for the Marias River below Tiber Reservoir are being cooperatively developed with the Bureau of Reclamation, irrigators, sportsmen and other interested parties. A minimum flow of 500 cfs in the Marias below Tiber was identified in the second draft of the "Tiber Reservoir and Marias River Recommended Operating Guidelines for Fish, Wildlife and Recreation" which was completed and released in February 1988. A verbal agreement with the Greenfields Irrigation District is in effect to maintain a minimum flow of 50 cfs in the Sun River below Diversion Dam. The trout population in the Sun River was surveyed at three locations during November 1987 (Table 1). The best trout population was found in the vicinity of Simms.

A total of 28 streams were visited several times to gather information to prescribe minimum reserved instream flows (Table 2). Data collection and analysis was completed for a majority of the streams investigated. Narrative summaries of field investigations and flow recommendations for each stream will be included in the MDFWP application submitted to the State Department of Natural Resources and Conservation to reserve instream flow in the Missouri River and its tributaries. Supporting fish data (Table 3) was collected for several of these streams.

Habitat Protection

Approximately 100 proposed projects that would alter streambeds or banks in nine different counties were reviewed during this report period under provisions of the Natural Streambed and Land Preservation Act of 1975 (SB 310). More than half of these were in Cascade and Lewis and Clark counties. In addition, approximately 40 projects were reviewed by regional and Helena staff pursuant to the Stream Preservation Act (SPA). Site inspections were made on many but not all of the "310" and SPA projects. No significant water discharge permit applications or renewals were received and no significant pollution complaints were received during the report period.

Habitat and Species of Special Concern

Regional personnel participated in review of three industry proposals affecting species of special concern and their habitat. One project involves a small hydro project that may affect grayling life history and survival in the Sun River Slope Canal. The other two proposals involve westslope cutthroat trout in several streams in the Badger-Two Medicine Area where exploratory drilling for oil and gas is planned. All three proposals are still under consideration.

Table 1. Electrofishing surveys of selected streams, 1987

Stream (Date)	Length of Section	Species ^{1/}	No. of Fish	Length Range	Weight Range
Deep Creek (11-5-87)	3/4 Mile	LL	1	3.3	
		LL	7	8.9-14.4	0.23-1.15
		Rb	2	3.4-16.8	0.23-1.92
		Wf	2	8.5-11.5	0.21-0.44
		+ WSu, LcSu, MtSu, LC, LnD, Sc			
Sun River - Below Div. Dam (11-4-87)	500 Yds.	Rb	15	4.6- 8.4	0.03-0.21
		Rb	7	10.2-13.8	0.38-0.80
		LL	1	12.6	0.69
		Eb	1	6.1	0.06
		Wf	4	3.5- 6.2	0.03-0.08
		+ LnSu, MtSu, Sc			
-287 Bridge (11-5-87)	1000 Yds.	LL	3	3.9- 5.5	0.03-0.05
		LL	11	7.3-16.5	0.16-1.47
		Rb	3	6.5-15.3	0.11-1.22
		Wf	2	13.3-14.9	0.86-0.98
		+ LnSu, MtSu, LnD, Sc			
-Simms Bridge (11-3-87)	1 Mile	LL	29	3.3- 5.8	0.03-0.06
		LL	20	7.1-13.0	0.12-0.94
		LL	15	16.2-22.5	1.44-3.54
		Rb	5	7.6-13.5	0.18-0.85
		Wf	6	3.7- 4.5	
		Wf	6	8.1-13.9	0.16-0.79
		Wf	1	18.4	2.00
		+ WSu, LnSu, MtSu, LnD, LC, Sc			

^{1/} Special abbreviations: LL-brown trout; Rb-rainbow trout; Wf-mountain whitefish; Eb-brook trout; LnSu-longnose sucker; MtSu-mountain sucker; Sc-mottled sculpin; LnD-longnose dace; WSu-white sucker; LC-lake chub.

Table 2. Central Montana streams investigated for minimum flow recommendations during 1987.

Drainage & Stream	Profile	Flows	Computer		Remarks
			Data	Write-up	
Dearborn River	X	X	X	-	Added transects '88
M. Fk. Dearborn	X	X	X	-	
S. Fk. Dearborn	X	X	X	-	
Flat Creek	X	X	X	-	
Marias River					
Dupuyer Cr.	X	X	X	X	
N. Fk. Badger Cr.	X	X	X	X	
N. Fk. Dupuyer Cr.	X	X	X	X	
S. Fk. Badger Cr.	X	X	X	X	
S. Fk. Dupuyer Cr.	X	X	X	X	
S. Fk. Two-Med. R.	X	X	X	X	
Missouri River					
Sheep Creek	X	X	X	-	
Smith River					
Birch Creek	X	X	X	-	
Eagle Creek	X	X	X	-	
Hound Creek	X	X	X	-	
Newlan Creek	X	X	X	-	
N. Fk. Smith R.	X	X	X	-	
Rock Creek	X	X	X	-	
Sheep Creek	X	X	X	-	
S. Fk. Smith R.	X	X	X	-	
Tenderfoot Cr.	X	X	X	-	
Sun River					
Elk Creek	X	X	X	X	
Ford Creek	X	-	-	-	Will complete '88
Teton River	X	X	X	X	
Deep Creek	X	X	X	X	
McDonald Creek	-	X	X	-	A spring creek
N. Fk. Willow Cr.	X	-	-	-	Will complete '88
Spring Creek	-	X	X	-	A spring creek
Willow Creek	X	-	-	-	Will complete '88

Table 3. Snorkel surveys conducted in 1987.

Stream	Date	Distance	Number Fish Observed*								Su	Sc
			Eb		LL		Rb		Ct			
			<6"	>6"	<6"	>6"	<6"	>6"	<6"	>6"		
Elk Ck.	8-24-87	495'	3		4	2	27	41			7	4
S. Fk. Dupuyer Ck.	8-25-87											
- Below Falls		175'							1	22		
- Above Falls		360'							1	5		
- Canyon Area		300'							10	19		
N. Fk. Dupuyer Ck.	8-25-87	300'	12	20					24	6		
S. Fk. Two Med. R.	8-26-87											
- Lost Shirt		400'							6	12		
- Sidney		200'							1	5		
Lost Shirt Ck.	8-26-87	240'							1	2		
Sidney Ck.	8-26-87	150'							2	2		
N. Fk. Badger Ck.	8-27-87	800'										3
S. Fk. Badger Ck.	8-27-87											
- Below Falls		600'		1						4		
- Above Falls		350'								6		

* Species abbreviations: Eb-brook trout; LL-brown trout; Rb-rainbow trout; Ct-cutthroat trout; Su-sucker; Sc-mottled sculpin.

Deep Creek

Brown trout were planted in Deep Creek in 1986 to expand the distribution and improve the fishery for this species. Survival of these fish appears to have been negligible according to scale analysis of fish collected by electrofishing (Table 1).

Harvest of Trout Over 12" in Rocky Mountain Front Streams

In 1975, creel limits in the forks of the Sun River were set at 2 rainbow and/or cutthroat trout (any size) to provide larger trout for anglers. This was changed to 3 fish with only one over 18" in 1983. The limit was changed again in 1984 to 3 fish, all of which had to be under 12". The latter two limits were set to conform to other Regional waters or adjacent Wilderness areas. In 1985, the trout limit of 3 fish under 12" was expanded to include all streams within the Lewis and Clark National Forest east of the Continental Divide from Highway 200 at Rogers Pass to Highway 2 near East Glacier. This limit is currently in effect but it may be too restrictive as some anglers would like to keep one trout over 12". Data on trout abundance and size is needed before making further changes in the regulations.

Rainbow trout in the South Fork of the Sun River were sampled by hook and line and marked with different color tags to separate fish less than or greater than 12". A total of 65 rainbow trout averaging 12.0 inches were marked and 51% were 12" or larger. A "recapture" run was conducted approximately one week later by snorkeling the same river section. Snorkelers recorded marked and unmarked fish and classified fish as less than or greater than 12". The rainbow population was estimated to be 187 trout/mile and snorkelers estimated about 19 percent of the trout were 12" or larger. Snorkelers had difficulty making the distinction between fish larger or smaller than 12 inches because many of the fish observed were in the 11 to 13 inch range.

Smith River

Flows in the Smith River became low enough in mid-summer 1987 to warrant initiating the process of purchasing water from Newlan Creek Reservoir to insure adequate trout survival. However, August rainfall increased late summer flows to the point where the planned water purchase was deemed unnecessary.

The voluntary creel card survey of floaters was continued in 1987. The survey form was simplified in an attempt to improve the poor response rate of 1986. This approach was unsuccessful as only 50 anglers completed and returned the cards in 1987. A Parks Division survey (Baxter 1987) estimated that at least 913 anglers floated the river between April and the end of August 1987, hence response to the voluntary creel survey was less than six percent. This was lower than response to the 1986 survey (9%, Leathe and Hill 1987). Due to poor success, the voluntary census was discontinued after the 1987 float season. In its place, a few general questions concerning fishing success were added to the Parks Division questionnaire that was given to floaters at the end of their trip at Eden Bridge in 1988. In addition, several questions concerning angler satisfaction were added to a mail survey

of floaters being conducted during 1988 as part of a Parks Division graduate study.

Mark-recapture population estimates were made by electrofishing three sections of the Smith River as scheduled in fall 1987. Data analysis and ageing of trout scales was not completed in time for inclusion in this report so results will appear in the next annual report. Preliminary indications are that trout populations in the Mid-canyon section rebounded significantly from the severely depressed level observed in fall 1986. However, fall 1987 electrofishing catch rates for rainbow and brown trout in this section were lower than those observed in 1984 and 1985.

Missouri River

River Flows and Trout Populations

Due to dry conditions during spring and summer of 1987, Missouri river flows could not be maintained at the desired level of 4100 cfs below Holter Dam. Mutually agreeable flows of 3000 to 3500 cfs were maintained through the summer and fall of 1987 through the cooperative efforts of the Bureau of Reclamation and the Missouri Reservoir Operations Advisory Committee which has regional MDFW&P representatives.

Trout population estimates were conducted in the Craig and Cascade sections during fall 1987 as scheduled and brown trout estimates were obtained in the same sections in spring 1988. Ageing of trout scales collected in conjunction with population estimates in the Craig section during 1982 through 1987 and in the Cascade section for 1981, 1982, 1986 and 1987 was completed to facilitate a consistent historic evaluation of the relationships between river flows and trout year class strength. This process involved ageing or re-reading scales from 3500 rainbow and 3100 brown trout. Problems with the computer program and personnel changes prevented the completion of year class analysis for this report.

Preliminary results of fall 1987 rainbow trout population estimates for various length groups are compared to findings for previous years in Table 4. Total rainbow trout numbers in the Craig section during 1987 were similar to past years but numbers of fish longer than 14 inches were the lowest recorded since 1982. The reasons for this apparent decline are currently unknown. Rainbow trout numbers were exceptionally high in fall 1987 in the Cascade section because of record numbers of yearling fish in the six to ten inch range (Table 4). Increases in yearling rainbow in the Cascade section during 1987 may be related to improved reproductive success in nearby Sheep Creek in spring 1986 resulting from removal of beaver dams that created barriers to spawners moving upstream. Tagging and trapping studies have shown Sheep Creek to be a critical spawning tributary for rainbows from the lower Missouri River (Leathe and Hill 1987). In contrast to results for the Craig section, numbers of rainbows 14 inches and longer in the Cascade section were higher in 1987 than in previous years (Table 4). Results for both sections indicate a substantial increase in numbers of "trophy" rainbows (over 18 inches long) following a change in fishing regulations that took effect on May 1, 1983. On that date the former limit of 10 pounds and one fish (or 10 fish) was replaced with a more restrictive limit of five fish including only one fish longer than 18 inches. Because of the confounding effects of

Table 4. Rainbow trout population size (number of fish per mile) by length group in two sections of the Missouri River during the fall of years 1981 through 1987.

Length (Inches)	Survey Year						
	1981	1982	1983	1984	1985	1986	1987
-----Craig Section-----							
6-10	-	538	1654	2130	924	1513	652
10-12	-	139	310	465	407	857	826
12-14	-	691	406	1016	796	456	1358
14-16	-	708	899	1128	896	839	637
16-18	-	208	314	563	435	516	319
≥ 18	-	4	10	33	69	45	54
Total ≥ 6"		2288	3593	5335	3527	4226	3846
Total ≥ 14"		920	1223	1724	1400	1400	1010
-----Cascade Section-----							
6-10	346	649	-	-	-	334	1340
10-12	206	91	-	-	-	564	533
12-14	289	128	-	-	-	108	317
14-16	298	231	-	-	-	202	330
16-18	142	118	-	-	-	192	197
≥ 18	17	7	-	-	-	51	61
Total ≥ 6"	1298	1224	-	-	-	1451	2778
Total ≥ 14"	457	356	-	-	-	445	588

spawning movements, fall brown trout population estimates are not considered to be reliable. Future analysis will focus on population trends of subadult brown trout in fall estimates and all age groups in spring estimates. These data have not yet been analyzed.

Rainbow Trout Recruitment

Traps were placed near the mouths of Little Prickly Pear Creek and the Dearborn River during spring 1988 to capture and mark rainbow trout migrating upstream from the Missouri River to spawn. The Little Prickly Pear trap was run intermittently between March 7 and May 5, 1988. A total of 2775 migrant rainbow were captured and marked. Upstream migration appeared to peak in the first half of April. Electrofishing surveys were conducted in two sections of the mainstem of Little Prickly Pear and in one section each on two tributaries (Lyons Creek and Wolf Creek) at or near peak spawning (April 22-28) to determine the percentage of marked fish and thus determine trapping efficiency. Significant numbers of marked fish were recaptured in all sections electrofished, allowing calculation of run size. Recapture efficiency for male spawners ranged from 12.5% to 21.0% in the four sections with an average efficiency of 15.9%. Since 1199 mature males were marked as they passed through the trap, the total run of males was estimated to be approximately 7500 fish. The number of mature females was not estimated because of problems with trap maintenance during the height of the spawning run and the knowledge that females spend substantially less time in the spawning areas than males. However, if the sex ratio of the run was 1:1, total run size for all rainbows would have approached 15,000 fish. For comparative purposes, approximately 4000 rainbow spawners have been estimated to use Sheep Creek near Cascade (Leathe and Hill 1987).

The spawning trap on the Dearborn River was run between March 16 and May 5, 1988. As was found for Little Prickly Pear, fish were at times reluctant to enter the trap so the block fence was periodically laid down to facilitate upstream movement. A total of 2361 mature rainbow trout were marked as they passed through the trap. Peak catches were made in late March and the first half of April. Similar to Prickly Pear, males migrated earlier (in March) while the April run was predominantly comprised of females. Three sections of the mainstem Dearborn ranging between two and three miles in length were electrofished between April 25 and 29 to determine the percentage of marked fish and thus, trapping efficiency. These sections were located approximately 18, 28, and 43 river miles upstream from the mouth of the Dearborn and substantial numbers of previously marked fish were captured in each section. Recapture efficiencies for mature males longer than 10 inches were very consistent, ranging from 11.3% to 13.0% for the three electrofishing sections with an average of 12.2%. Since 1166 mature males were marked at the trap site the total run of male rainbow was estimated to be approximately 9600 fish. If the overall sex ratio of the run was 1:1 then about 20,000 Missouri River rainbows spawned in the Dearborn River drainage during spring 1988. If time allows, the sex ratio of maturing rainbows in the Missouri River will be determined during the course of fall 1988 electrofishing surveys of the Craig and Cascade sections.

A helicopter survey of 42 miles of the Dearborn River was conducted on April 8, 1988 to determine the distribution and intensity of rainbow trout spawning. Visibility was excellent and spawning areas were easily identified

because of abnormally low water due to near-drought conditions. Approximately 6000 redds were estimated but this is a very approximate count due to extensive amounts of redd superimposition in nearly every spawning riffle. Based on trapping results, electrofishing surveys and aerial observations of spawning fish on redds it was estimated that spawning was about 2/3 complete on this date. Redd density was highest between river mile 10 and 20 (219 to 232 redds per mile) but spawning was fairly evenly distributed (123 to 232 redds per mile) in the entire lower 30 river miles. Spawning use declined significantly above river mile 35 and appeared negligible above river mile 40. As a point of reference, the Highway 200 bridge is located at river mile 29.5.

A similar survey was conducted on the 34 mile section of the Missouri River between the town of Cascade and Holter Dam on May 5, 1988. Although observation conditions were good, relatively few rainbow trout redds were observed. A total of about 600 redds was estimated but this may have been an overestimate. The only major concentration observed was located immediately downstream from the mouth of Wegner Creek where 200-300 redds were counted.

Creel Survey

A creel survey was conducted on the Missouri River between Holter Dam and Ulm from April 5 through September 20, 1987. The purpose of the survey was to determine the downstream distribution of hatchery rainbow trout that were flushed from Holter Reservoir as well as their contribution to the creel. The survey was also used to monitor trends in angler success and other characteristics of the fishery. Creel interview information was gathered from five main river reaches similar or identical to those described by Berg (1981, 1982). The Holter section was 2.5 miles long and was located between Holter Dam and the first downstream bridge (Wolf Creek Bridge). The Craig section was about 11 miles long, between Wolf Creek Bridge and the mouth of the Dearborn River. The Hardy section was about 10 miles long, from the Dearborn River to the mouth of Sheep Creek. The Cascade section ran from Sheep Creek to the town of Cascade (11 river miles) and the Ulm section covered the 22 river miles between Cascade and Ulm. The entire river segment between Holter Dam and Ulm was approximately 56.5 miles long.

Results of the 1987 survey are presented in Appendix Tables A1 through A5. A monthly data summary (Table A1) indicated that during the months of April through June residents of Cascade County (Great Falls area) comprised 70 to 80% of the users and most anglers used bait during this period. Non-residents and anglers from non-local Montana counties became more abundant in July through September when numbers of bait and fly anglers became approximately equal. Almost all of the 2050 anglers interviewed reported fishing for "trout" or "any fish" (Table A2).

Some longitudinal trends in fishing method were noted. Bait anglers predominated in most areas, especially in the Holter and Ulm sections (Table A2). Numbers of anglers using artificials (lures and flies) only slightly outnumbered bait anglers in the Craig section (49% versus 37%; Table A2). This directly contrasted with results for a similar time period in 1986 when 79% of anglers in the Craig section used artificials compared to 16% using bait (Leathe and Hill 1987). This anomaly is explained by differences in survey method in the two years. The 1986 survey was very intensive, covering

only eight river miles and a much higher percentage of all anglers was interviewed. The 1987 survey was extensive, covering 56.5 river miles and emphasis was placed on maximizing number of angler contacts. As a result, shore anglers close to roads and access points were "oversampled" relative to their true abundance in 1987.

To illustrate this point, 479 shore anglers and only 204 boat anglers were interviewed in the Craig section during the 1987 survey (Tables A4 and A5). This would imply that shore anglers were more than twice as abundant as boat anglers but 1986 results showed very clearly that fishing pressure by boat anglers was slightly greater than for shore anglers in the Craig section (Leathe and Hill 1987). Findings of the 1987 survey were biased because shore anglers fished predominantly with bait (55% of anglers; Table A4) while boat anglers mostly used artificials (71%; Table A5).

Overall, boat anglers had higher catch rates for rainbow and brown trout than shore anglers but harvest rates for the two groups were identical (Tables A4 and A5). Fly fishermen had the highest catch rates for rainbow and brown trout but also had the lowest harvest rates, indicating they released about 90% of the trout they caught. Lure and bait anglers experienced lower catch rates but harvested a much greater percentage of their catch.

Results of the 1987 creel survey are compared to results of similar surveys conducted by Berg (1981, 1982) in Tables 5 through 11. Average catch rates for both rainbow and brown trout (0.42 and 0.04 per hour) were higher in 1987 than in previous years (Table 5). However, harvest rates for rainbow in 1987 were substantially less than in past years indicating that anglers released significantly more fish in 1987. Although 1987 brown trout catch rates were higher than in the past, harvest rates were unchanged indicating that a greater percentage of brown trout were also released. This trend may be related to a change in fishing method. In 1980 and 1981 17% and 14% of all anglers interviewed used artificials compared to 38% in 1987. In summary, during the past six years the frequency of use of artificial baits has doubled and harvest rates have declined by 50% in spite of the fact that catch rates have remained the same or even increased. Catch rates for rainbow trout were higher than in past years in the Craig, Hardy, and Ulm sections but lower or unchanged in the Holter and Cascade sections (Tables 7 through 11).

The percentage of non-resident anglers increased from 8-11% in 1980 and 1981 to 14% in 1987 (Table 6). It is likely that these figures underestimate the true percentage of non-resident anglers due to survey design. Results of the 1986 survey indicated 27% of anglers in the Holter section and 33% of anglers in the Craig section were non-residents. Boat anglers were undersampled in 1987 and the percentage of non-residents fishing from boats was nearly double that of shore anglers. Studies from other "blue ribbon" trout rivers in Montana east of the continental divide reveal non-resident use ranging from 23% of anglers on the Yellowstone River to 91% on the upper Madison River with an average of about 45% (Fredenberg 1985).

Table 5. Comparison of monthly creel survey statistics for the Missouri River between Holter Dam and Ulm during 1980, 1981 and 1987.

Creel statistic & survey year	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Total
No. anglers interviewed									
1980	42	86	194	238	81	46	33	--	720
1981	230	69	486	464	734	178	238	122	2521
1987	160	436	436	316	506	196	--	--	2050
Rh caught per man-hour									
1980	0.31	0.27	0.19	0.32	0.75	0.71	0.29	--	0.36
1981	0.20	0.16	0.47	0.27	0.38	0.40	0.59	0.54	0.39
1987	0.20	0.45	0.38	0.60	0.42	0.34	--	--	0.42
Rh harvested per man-hour									
1980	0.28	0.23	0.17	0.28	0.43	0.59	0.19	--	0.28
1981	0.17	0.16	0.43	0.25	0.28	0.25	0.40	0.35	0.31
1987	0.12	0.23	0.18	0.12	0.07	0.08	--	--	0.14
Brown tr. caught/man-hour									
1980	0.01	0.03	0.02	0.01	0.01	0.00	0.02	--	0.01
1981	0.03	0.00	0.01	0.01	0.02	0.02	0.04	0.05	0.02
1987	0.02	0.03	0.03	0.06	0.04	0.05	--	--	0.04
Brown tr. harvested/man-hour									
1980	0.01	0.03	0.02	0.01	0.01	0.00	0.02	--	0.01
1981	0.03	0.00	0.01	0.01	0.01	0.01	0.02	0.01	0.01
1987	0.01	0.02	0.01	0.01	0.01	0.01	--	--	0.01

Table 6. Origin of anglers fishing the Missouri River between Holter Dam and Ulm during 1980, 1981 and 1987.

Angler origin	1980	1981	1987
Cascade County	67.5%	69.8%	63.7%
Lewis & Clark Co.	12.9%	8.6%	10.9%
Other Montana	11.9%	11.0%	11.3%
Out-of-State	7.6%	10.6%	14.1%

Table 7. Number of anglers interviewed and catch information for the Holter section of the Missouri River during 1980, 1981 and 1987.

Statistic	1980	1981	1987
No. anglers interviewed	273	1374	570
Rb caught per hour	0.46	0.41	0.38
Rb harvested per hour	0.38	0.36	0.19
Brown trout caught/hour	0.01	0.01	0.02
Brown trout harvested/hr.	0.00	<0.01	0.01

Table 8. Number of anglers interviewed and catch information for the **Craig section** of the Missouri River during 1980, 1981 and 1987.

Statistic	1980	1981	1987
No. anglers interviewed	239	581	683
Rb caught per hour	0.32	0.39	0.48
Rb harvested per hour	0.21	0.24	0.13
Brown trout caught/hour	0.02	0.03	0.05
Brown trout harvested/hr.	0.02	0.01	0.01

Table 9. Number of anglers interviewed and catch information for the **Hardy section** of the Missouri River during 1980, 1981 and 1987.

Statistic	1980	1981	1987
No. anglers interviewed	185	410	492
Rb caught per hour	0.25	0.37	0.45
Rb harvested per hour	0.22	0.26	0.10
Brown trout caught/hour	0.02	0.04	0.04
Brown trout harvested/hr.	0.02	0.02	0.01

Table 10. Number of anglers interviewed and catch information for the **Cascade section** of the Missouri River during 1980, 1981 and 1987.

Statistic	1980	1981	1987
No. anglers interviewed	17	55	158
Rb caught per hour	0.20	0.48	0.32
Rb harvested per hour	0.17	0.14	0.12
Brown trout caught/hour	0.07	0.11	0.03
Brown trout harvested/hr.	0.05	0.01	0.01

Table 11. Number of anglers interviewed and catch information for the **Ulm section** of the Missouri River during 1980, 1981 and 1987.

Statistic	1980	1981	1987
No. anglers interviewed	6	101	96
Rb caught per hour	0.08	0.09	0.14
Rb harvested per hour	0.08	0.08	0.14
Brown trout caught/hour	0.00	0.01	0.01
Brown trout harvested/hr.	0.00	0.01	0.01

Contribution Of Hatchery Rainbow

Of the total of 570 rainbows measured from angler creels during 1987, 258 were examined under ultraviolet light to determine presence or absence of the orange fluorescent pigment mark applied to the 325,000 hatchery rainbow trout planted in Holter Reservoir annually in 1986 and 1987. Forty-four of the fish examined were found to be of hatchery origin. Ninety-eight percent of the hatchery fish were caught by anglers in the Missouri River within 0.3 miles of Holter Dam and the remaining fish was caught 0.5 miles below the dam. No rainbow of hatchery origin were found after June 22. All known hatchery fish were from the July 1986 plant and ranged from 10.9 to 13.7 inches long at the time of capture. Further analysis suggests that 83% of the rainbow trout in this size range caught by anglers in the first half mile of river below Holter in April, May, and June were hatchery fish. Fall electrofishing surveys in the Holter tailwater indicated approximately 1700 hatchery rainbow present in 1986 and markedly fewer fish present in fall 1987 (Lere 1986, 1987). Low numbers of hatchery fish in the tailwater were attributed to abnormally low spring runoff and subsequent minor flushing losses in both years.

DISCUSSION AND RECOMMENDATIONS

Cooperation with the Bureau of Reclamation and the Greenfields Irrigation District should continue to find ways to enhance flows in the Marias River below Tiber Dam and in the Sun River below Diversion Dam. Monitoring trout populations in these rivers should continue to determine response to any flow enhancements that occur. Water purchases from Newlan Creek Reservoir should be made to maintain flows in the Smith River as needed in the future. Close cooperation with the Bureau of Reclamation and Montana Power Company should continue to insure stable adequate flows in the Missouri River and reservoir complex. Fieldwork and final write-ups of instream flow work on regional streams must be completed during the next report period to be included in the upcoming MDFW&P water reservation application. Reviews of projects that may alter the beds and/or banks of regional streams must be continued under the "310" and SPA laws to protect fish habitat. Water discharge permit applications and pollution complaints will be responded to as they arise.

Monitoring of selected regional streams will be continued to assess fish population trends and status and to prescribe management actions to maintain or improve the fishery. Additional data should be gathered to determine the feasibility of allowing harvest of trout over 12" in selected streams along the Rocky Mountain Front and initial efforts should focus on both forks of the Sun River above Gibson Dam. Fish population data gathered on the Smith River during fall 1987 should be analyzed to determine whether special regulations imposed in 1985 have had a beneficial effect. Possible adjustments in Smith River fishing regulations should be considered pending the results of trout population trend analysis and a floater preference survey conducted in 1988.

As a result of controversy surrounding restrictive fishing regulations proposed in fall 1987 for the Craig section of the Missouri River it has become imperative to complete a management plan for the river in FY89 which is one year earlier than planned. Alternative fishing regulations to improve the quality of rainbow and brown trout fisheries in the river should be considered in this planning process. A computerized fish population simulation model should be employed to evaluate fishing regulation alternatives. Year class analysis initiated in this report period for rainbow and brown trout should be continued and completed in the next year to allow more detailed investigation of population dynamics and effects of flow levels and angler harvest. Spring and fall population estimates should be continued in the Craig and Cascade section to monitor trout populations with respect to angler harvest, river flows, contribution of hatchery rainbow, and spawning enhancement measures in tributaries. Creel surveys to monitor distribution and harvest of hatchery rainbow should be discontinued until the return of normal or above normal spring runoff with associated spills over Holter Dam. However, mass marking of hatchery rainbow planted in Holter Reservoir should continue to allow proper evaluation of flushing effects when normal runoff occurs.

Results of studies conducted on three Missouri River tributaries over the past three years indicate that probably 80% or more of all rainbow trout recruitment to the river is from these streams. Future management efforts should focus on means to enhance reproductive success in these critical tributaries. Acquisition of available water rights for instream purposes should be top priority if institutional frameworks and funding sources are established in the near future to make this possible. Dewatering due to irrigation is a major problem and losses of emigrating fry in unscreened diversion canals needs to be evaluated. Efforts initiated in 1986 to improve passage of adult rainbow trout in Sheep Creek should be continued and expanded to the Little Prickly Pear drainage. Beaver dams have created insurmountable barriers to upstream migration of rainbow spawners in Sheep Creek and Little Prickly Pear Creek and removal of key dams will increase distribution of spawners and probably improve reproductive success in these drainages. Irrigation diversions also create barriers to rainbow and/or brown trout adults at times in two areas on Little Prickly Pear Creek. Screening of irrigation canals should be considered on two locations on Little Prickly Pear and two or three locations on the Dearborn River. Alternatives to screening such as assisting in the installation of sprinkler systems, purchasing water rights, and assisting in development and installation of more acceptable diversion structures should be evaluated. The importance of these tributaries for brown trout recruitment should also be determined. Tributary enhancement efforts should be coupled with monitoring of river trout populations to determine effectiveness of improvement efforts.

ACKNOWLEDGEMENTS

Paul Hamlin, Les Evarts and Ken Sinay were fisheries fieldworkers who conducted or assisted on nearly all of the field activities conducted on this project during the report period. They also assisted in compiling and summarizing data presented herein and their dedicated efforts are appreciated. Jan Boyle conducted interviews of 2050 anglers on the Missouri River with admirable patience and persistence. Scott Rumsey and Bryce Christianson assisted in trout population surveys on the South Fork of the Sun River. Ken Frazer and Mark Albers conducted snorkel surveys on other Rocky Mountain Front streams and Woody Baxter assisted on Smith River electrofishing. Ken Frazer and Jerry Mayala assisted with electrofishing surveys in the Little Prickly Pear drainage to determine distribution of migratory rainbow trout spawners during spring 1988.

LITERATURE CITED

- Baxter, G. Woody. 1987. Smith River Annual Report for 1987. Montana Department of Fish, Wildlife and Parks. Great Falls, Montana. 29 pages.
- Berg, R.K. 1981. Middle Missouri River planning project. Montana Department of Fish, Wildlife and Parks. Job Progress Report. Project FW-3-R-9, Job 1-a. Helena, Montana. 39 pages.
- Berg, R.K. 1982. Middle Missouri River planning project. Montana Department of Fish, Wildlife and Parks. Job Progress Report. Project FW-3-R-10, Job 1-a. Helena, Montana. 27 pages.
- Fredenberg, Wade. 1985. Bighorn River creel census. Montana Department of Fish, Wildlife and Parks. Helena, Montana. 56 pages.
- Leathe, S.A. and W.J. Hill. 1987. Northcentral Montana fisheries study-inventory and survey of cold water fish populations in rivers and streams. Montana Department of Fish, Wildlife and Parks. Job Progress Report, Project F-5-R-36, Job II. Helena, Montana. 38 pages.
- Lere, Mark. 1986. Mid-Missouri reservoirs study. Montana Department of Fish, Wildlife and Parks. Job Progress Report, Project F-36-R-2, Job II-f. Helena, Montana. 66 pages.
- Lere, Mark. 1987. Mid-Missouri reservoirs study. Montana Department of Fish, Wildlife and Parks. Job Progress Report, Project F-46-R-1, Job II-f. Helena, Montana. 55 pages.
- Nelson, F.A. 1984. Guidelines for using the wetted-perimeter (WETP) computer program of the Montana Department of Fish, Wildlife and Parks. Montana Department of Fish, Wildlife and Parks, Bozeman, Montana. 58 pages.
- Vincent, E.R. 1971. River electrofishing and fish population estimate. Progressive Fish Culturist. 33(3):163-169.

Prepared By: Stephen A. Leathe, William J. Hill, and Alfred Wipperman

Date: September 1988

Principal Fish Species Involved:

Rainbow trout, brown trout, cutthroat trout, brook trout, arctic grayling and mountain whitefish.

Code Numbers Of Waters Referred To In Report:

14-1280	Deep Creek	17-4896	Missouri River Sec 09
14-1640	Dupuyer Creek	17-5200	Newlan Creek
14-3200	Lost Shirt Creek	17-5472	N. Fk. Smith River
14-3240	Marias River Sec. 01	17-6224	Rock Creek
14-3360	McDonald Creek	17-6544	Sheep Cr. (Wt. Sulphur)
14-3760	No. Fk. Badger Creek	17-6576	Sheep Cr. (Cascade)
14-3840	No. Fk. Dupuyer Creek	17-6832	Smith River Sec 02
14-5080	Sidney Creek	17-6928	S. Fk. Dearborn River
14-5360	So. Fk. Badger Creek	17-7056	S. Fk. Smith River
14-5480	So. Fk. Dupuyer Creek	17-7532	Tenderfoot Creek
14-5680	So. Fk. Two Medicine R.	20-2000	Elk Creek
14-5760	Spring Creek	20-2150	Ford Creek
14-6040	Teton River Sec. 02	20-4450	No. Fk. Willow Creek
17-0720	Birch Creek	20-5600	So. Fk. Sun River
17-2064	Dearborn River	20-6100	Sun River Sec. 02
17-2480	Eagle Creek	20-	Sun River Slope Canal
17-2800	Flat Creek	20-6500	Willow Creek
17-3600	Hound Creek		
17-4224	Little Prickly Pear Cr.		
17-4432	Lyons Creek		
17-4656	M. Fk. Dearborn River		

Table A1. Monthly summary of creel survey data collected from anglers on the Missouri River between Holter Dam and Ulm during April through September, 1987.

Creel survey Statistics	Apr.	May	June	July	Aug.	Sept.	Total
No. anglers interviewed	160	436	436	316	506	196	2050
Ave. hrs. fished/angler	2.27	2.46	2.65	2.71	2.88	2.77	2.66
No. completed trips	22	37	70	61	135	38	363
Ave. hrs./completed trip	3.72	3.24	3.97	3.90	4.31	4.40	4.04
<u>Fish caught/man hour:</u>							
Rainbow trout	0.20	0.45	0.38	0.60	0.42	0.34	0.42
Brown trout	0.02	0.03	0.03	0.06	0.04	0.05	0.04
Whitefish	0.06	0.09	0.12	0.24	0.08	0.11	0.12
<u>Fish harvested/man hour:</u>							
Rainbow trout	0.12	0.23	0.18	0.12	0.07	0.08	0.14
Brown trout	0.01	0.02	0.01	0.01	0.01	<0.01	0.01
Whitefish	<0.01	0.02	0.01	0.05	0.01	0.01	0.02
<u>Composition of catch:</u>							
% rainbow trout	70.2	78.6	71.9	66.8	77.2	69.3	73.0
% brown trout	7.7	5.5	5.6	6.5	7.5	9.4	6.7
% whitefish	22.1	15.9	22.5	26.7	15.3	21.3	20.3
<u>Angler residency:</u>							
% Cascade Co.	80.0	72.5	71.0	59.1	52.6	51.0	63.7
% Lewis & Clark Co.	9.4	8.0	10.1	7.9	11.5	23.5	10.9
% Other MT	6.9	9.6	9.7	13.3	12.0	16.8	11.3
% Non-resident	3.7	9.9	9.2	19.1	23.9	8.7	14.0
% Foreign	0.0	0.0	0.0	0.6	0.0	0.0	<0.1
<u>Method:</u>							
% Lures	15.0	16.7	14.7	10.1	10.9	7.2	12.8
% Flies	11.9	14.9	16.1	40.5	32.4	40.3	25.6
% Spawn	3.1	--	--	--	--	0.5	0.3
% Other bait	45.0	60.6	57.1	37.7	36.8	36.7	46.9
% Combo	25.0	7.8	12.1	11.7	19.9	15.3	14.4

Table A2. Summary of creel survey information gathered from anglers fishing five specific sections or the "upper half" of the Missouri River between Holter Dam and Ulm during April through September, 1987.

Creel survey statistic	Creel survey section						Total
	Holter	Craig	Hardy	Cascade	Ulm	Upper half	
No anglers interviewed	570	683	492	158	96	51	2050
Ave. hrs. fished/angler	2.45	2.84	2.48	2.51	2.45	4.99	2.66
No. completed trips	47	169	49	48	13	37	363
Ave. hrs./completed trip	3.71	3.84	4.77	4.16	2.50	5.00	4.00
<u>Fish caught/man hour:</u>							
Rainbow trout	0.38	0.48	0.45	0.32	0.14	0.58	0.40
Brown trout	0.02	0.05	0.04	0.03	0.01	0.04	0.03
Whitefish	0.18	0.14	0.06	0.04	<0.01	0.09	0.13
<u>Fish harvested/man hour:</u>							
Rainbow trout	0.19	0.13	0.10	0.12	0.14	0.11	0.14
Brown trout	0.01	0.01	0.01	0.01	0.01	0.01	0.02
Whitefish	0.05	0.01	0.01	<0.01	<0.01	<0.01	0.03
<u>Composition of catch:</u>							
% rainbow trout	64.6	66.4	82.1	81.9	89.2	81.3	73.0
% brown trout	3.9	7.6	7.6	7.8	8.1	5.5	6.7
% whitefish	31.5	26.0	10.3	10.3	2.7	13.2	20.3
<u>Method:</u>							
% Lures	6.7	15.7	13.6	24.1	6.2	11.8	12.8
% Flies	20.5	33.1	27.0	15.8	3.1	41.2	25.6
% Spawn	0.7	0.3	--	--	--	--	0.3
% Other bait	60.2	36.9	43.9	49.4	69.8	11.8	46.9
% Combination	11.9	14.1	15.4	10.8	20.8	35.3	14.4
<u>Target species:</u>							
% Rainbow trout	1.1	0.2	0.2	0.6	--	--	0.5
% Brown trout	--	--	--	--	--	--	--
% Whitefish	--	--	--	--	--	--	--
% Trout (general)	86.3	92.1	88.8	86.6	78.1	100.0	88.8
% Trout & whitefish	1.6	1.0	0.2	--	--	--	0.8
% Walleye	--	--	--	--	--	--	--
% Trout & walleye	1.4	--	--	--	--	--	0.4
% Any fish	9.6	6.7	10.8	12.8	19.8	--	9.4
% Other	--	--	--	--	2.1	--	0.1

Table A3. A comparison of the success rates of anglers using various methods and modes of fishing on the Missouri River between Holter Dam and Ulm during April through September, 1987.

	No. of anglers	% of anglers	Ave. hrs. fished/ angler	Fish caught/ man hour		Fish harvested/ man hour		Composition of catch	
				Rainbow	Brown	Rainbow	Brown	% Rb	% LL
<u>Method:</u>									
Lures	262	12.8	2.30	0.40	0.04	0.16	0.02	89.9	10.1
Flies	525	25.6	3.37	0.72	0.08	0.07	0.01	89.9	10.1
Spawn	6	0.3	3.73	0.76	--	0.58	--	100.0	--
Other bait	962	46.9	2.34	0.27	0.01	0.19	0.01	95.4	4.6
Combination	295	14.4	2.72	0.23	0.01	0.09	<0.01	94.3	5.7

Table A4. Summary of information gathered from shore anglers fishing five sections of the Missouri River between Holter Dam and Ulm during April through September, 1987.

Creel survey statistics	Creel survey section					Total
	Holter	Craig	Hardy	Cascade	Ulm	
No. anglers interviewed	531	479	437	124	96	1667
Ave. hrs. fished/angler	2.33	2.42	2.19	1.98	2.44	2.30
No. completed trips	32	36	10	18	13	109
Ave. hrs./completed trip	3.10	2.90	3.50	3.10	2.50	3.0
<u>fish caught/man hour:</u>						
Rainbow trout	0.35	0.47	0.36	0.09	0.14	0.36
Brown trout	0.02	0.05	0.03	<0.01	0.13	0.03
Whitefish	0.17	0.13	0.06	--		0.11
<u>Fish harvested/man hour:</u>						
Rainbow trout	0.18	0.12	0.12	0.09	0.14	0.14
Brown trout	0.01	0.01	0.01	<0.01	0.01	0.01
Whitefish	0.05	0.05	0.01	--	<0.01	0.02
<u>Composition of catch:</u>						
% rainbow trout	64.8	71.2	79.9	95.8	89.2	71.6
% brown trout	3.9	8.2	7.2	4.2	8.1	6.4
% whitefish	31.3	20.6	12.9	--	2.7	22.1
<u>Method:</u>						
% lures	6.4	13.6	15.1	17.7	6.2	11.6
% flies	19.8	26.1	20.1	8.1	3.1	19.9
% spawn	0.4	0.4	--	--	--	0.2
% other bait	62.1	48.9	49.2	60.5	69.8	55.2
% combination	11.3	11.1	15.6	13.7	20.8	13.1

Table A5. Summary of information gathered from **boat anglers** fishing four sections of the Missouri River between Holter Dam and Ulm during April through September, 1987.

Creel survey statistic	Creel survey section				Total
	Holter	Craig	Hardy	Cascade	
No. anglers interviewed	39	204	55	39	337
Ave. hrs. fished/angler	4.06	3.82	4.76	3.89	4.01
No. completed trips	15	133	39	30	217
Ave. hrs./completed trip	5.00	4.10	5.10	4.80	4.39
<u>Fish caught/man hour:</u>					
Rainbow trout	0.57	0.50	0.77	0.69	0.58
Brown trout	0.04	0.05	0.08	0.07	0.06
Whitefish	0.29	0.15	0.05	0.11	0.14
<u>Fish harvested/man hour:</u>					
Rainbow trout	0.21	0.14	0.04	0.18	0.14
Brown trout	0.01	0.02	--	0.02	0.01
Whitefish	--	0.01	--	0.01	0.01
<u>Composition of catch:</u>					
% Rainbow trout	63.6	70.8	86.0	79.4	74.3
% Brown trout	4.2	7.5	8.5	8.4	7.4
% Whitefish	32.2	21.7	5.5	12.2	18.3
<u>Method:</u>					
% lures	10.3	20.6	1.8	47.1	19.0
% flies	30.8	49.5	81.8	44.1	52.0
% spawn	5.1	--	--	--	0.6
% Other bait	33.3	8.8	1.8	8.8	10.5
% Combination	20.5	21.1	14.5	--	17.8

MONTANA DEPARTMENT OF FISH, WILDLIFE AND PARKS

FISHERIES DIVISION
JOB PROGRESS REPORT

STATE: MONTANA PROJECT TITLE: STATEWIDE FISHERIES INVESTIGATION
PROJECT NO.: F-46-R-2 STUDY TITLE: SURVEY AND INVENTORY OF COLDWATER LAKES
JOB NO.: II-a JOB TITLE: NORTHWEST MONTANA COLDWATER LAKES INVESTIGATIONS
PERIOD COVERED: JULY 1, 1988 THROUGH JUNE 30, 1989

ABSTRACT

Ashley Lake water levels were regulated to minimize impacts of seasonal drawdowns on fisheries. Full storage capacity was reached by late May to release adequate fisheries flows into Ashley Creek. Winter fishing pressure and harvest at Lake Mary Ronan increased significantly in 1989 compared to 1988. An estimated 8,132 anglers harvested 71,561 fish (99 percent kokanee) at a rate of 8.8 fish per angler in 1989. Total winter fishing pressure and kokanee harvest was determined for Little Bitterroot Lake. Estimated fishing pressure was 1,699 angler days resulting in a harvest of 16,182 fish. Foy Lake winter harvest and fishing pressure was very low, in part due to critically low dissolved oxygen concentration. An estimated 1,245 anglers harvested 414 rainbow trout at an hourly catch rate of 0.24 fish.

In May, 1989, a summer creel census was initiated at Lake Mary Ronan. Findings will be presented in the FY90 job completion report.

Gill netting data were collected for Lake Mary Ronan and Hungry Horse Reservoir. Kokanee populations were monitored in 10 lakes for size trends and age structure of spawning fish. Mysis monitoring was continued for five lakes in 1988.

BACKGROUND

The lake fisheries resource in Region 1 is comprised of 645 lakes totaling 240,000 acres. Included is a total of 412 coldwater lakes. The total estimated fishing pressure of Region 1 (1985-1986) as determined by a statewide mail questionnaire survey was 515,976 mandays of fishing effort. Approximately 67 percent (345,704 days) of the angling pressure was expended on trout lakes. With the increase of fishing pressure in recent years, large trout regulations have been adopted on several lakes to provide anglers the opportunity to catch larger fish. The monitoring of the fisheries resources is an ongoing effort to update the management programs for maintaining or improving the fisheries.

OBJECTIVES AND DEGREE OF ATTAINMENT

1. To manage lake and reservoir water levels to minimize impacts on fish populations. Objective accomplished utilizing state funding.
2. To maintain water quality at present levels as measured by Water Quality Bureau. Objective accomplished utilizing state funding.
3. To maintain aquatic habitat at a level capable of sustaining existing populations. Objective accomplished using state funding.
4. To increase the opportunity to catch larger trout (14" at 0.5 fish/hour) in specified lakes. Objective accomplished.
5. Provide lake fisheries to sustain an increase of 32,600 angler days by 1992 through natural reproduction and hatchery plants. Provide kokanee fisheries for 12"-14" fish at a catch rate of 1 fish per hour. Objective accomplished.
6. To provide a variety of trout sizes and species for angling and prey on stunted salmon. Objective accomplished. Introduced kamloops trout into Lake Koocanusa and Little Bitterroot Lake. Introduced brown trout into Noxon Rapids Reservoir.
7. To manage regulations and stocking to protect or expand species of special concern. Objective accomplished with state funding. A supplemental report on fish genetics of westslope cutthroat trout for several high mountain lakes has been completed (F-46-R-1, I-a, Species of Special Concern Segment).
8. To develop management plans to adapt to the introduction of Mysis and other unwanted species. Objective partially accomplished. Mysis population trends are being monitored annually in several lakes where kokanee and mysids co-exist to determine impacts on fish communities.
9. Coordinate with other agencies to maintain fisheries and water quality at or above present levels. Objective was accomplished using state funding.
10. To encourage public participation in understanding the problems and strategies of resource management. Objective was accomplished. The Swan River drainage plan was prepared and submitted for public review with emphasis directed toward the restoration of adfluvial westslope cutthroat trout in Swan Lake.
11. Attempt to acquire and provide facilities on all lakes and reservoirs capable of sustaining more than 300 man days of fishing per year on a priority basis at the rate of one lake per year. Access acquired on Lower and Upper Thompson lakes in FY1989. Objective was accomplished using state funding.

PROCEDURES

A winter creel census was conducted at Lake Mary Ronan to monitor fishing pressure and kokanee harvest trends. Information derived from fishermen interviews included number of anglers per party, hours fished, fish caught, fish species, and residency of anglers. Traffic counters were installed at two locations to enumerate vehicle traffic by fisherman accessing the lake. Total angling pressure and fish harvest estimates were expanded from traffic counter and angler interview data.

A summer creel census was initiated in May of 1989. Data were collected from angler interviews and expanded using boat counts at 2-hour intervals on weekend days and randomly selected weekdays.

A winter creel census was conducted for Little Bitterroot Lake to determine the utilization of abundant kokanee populations. Data were collected from angler interviews and expanded using angler counts taken on the lake at 3-hour intervals on randomly selected days. The computer program used to estimate total fish harvest and fishing pressure was designed by McFarland and Roche (1987).

Lake fish population surveys were conducted using experimental nylon gill nets measuring 6 feet deep by 125 feet in length with a bar mesh size of 3/4, 1, 1 1/2, 1 3/4, and 2 inches. A monofilament net 100 foot by 16 feet deep with bar mesh size of 1/2 and 3/4 inch was used to fish kokanee in Little Bitterroot and Foy lakes. A 300 foot beach seine was employed to collect mature salmon samples in conjunction with kokanee spawn-taking operations.

Lake gauge elevations were measured with a standard USGS 6.33 foot staff gauge to determine storage capacity measurements of Ashley Lake.

Zooplankton samples were collected using a conical Wisconsin plankton net of 153 micron nitex mesh with a 0.2921 diameter opening. Replicate 30 meter vertical hauls were taken at each station. Samples were preserved in 4 percent formalin mixed with 40 grams per liter sucrose. Samples were then diluted in one millimeter subsamples. Cladocerans and copepods were identified in a Sedgewick-Rafter counting cell under 40 power magnification.

Mysid samples were collected during the dark phase of the moon in early June approximately 2 hours after sunset. Replicate depth hauls were taken through the entire water column using a conical Wisconsin style net one meter in diameter having a mesh size of 500 microns. Samples were preserved in 10 percent formalin, counted under a microscope and categorized as juveniles or adults (<10 mm and >10 mm respectively).

RESULTS AND DISCUSSION

Special Trout Regulation Lakes

Because of time constraints and other priorities, a creel census for special trout regulations to determine fisherman use, catch rates, and average size of angler catch was not initiated in 1989.

Woods Lake was designated as a catch-and-release trout fishery in May of 1984. Gill netting efforts in the summer of 1986 indicated few fish remained in the lake. The catch decreased from 11 fish per net night in 1984 to 3.5 fish in 1986. Growth increments of rainbow trout stocked as 5-inch fish averaged only 3.5 inches per year over a 3-year period. The main food items of these fish included leeches, dragonfly larvae, and snails. Although redbside shiners were readily available as forage fish, they did not show up as a significant food source in the diet of trout. It is believed that redbside shiners were more in competition with trout for food than providing a forage fish species for trout. Woods Lake was rehabilitated using state funding in the fall of 1988 and stocked with 7-inch Arlee rainbow in the summer of 1989. Follow up gill net surveys will be conducted to assess growth increments of rainbow trout without the presence of redbside shiners.

Special trout regulations for Region 1 lakes in 1988 were changed from catch-and-release to 1 fish daily with a maximum size length of 22 inches for Woods, Spencer, Bootjack, and Metcalf lakes. No Tellum Lake regulations remained the same, only 2 fish which must exceed 14 inches.

Lake Mary Ronan Winter Creel Census

A winter creel census was conducted at Lake Mary Ronan for the fifth consecutive year to determine total use and harvest trends of kokanee and trout. The data will be used, in part, to formulate future management strategies for maintaining or improving the fishery.

In 1989, 9 weekdays were randomly selected and were censused during a 70-day period, January 4 through March 15. Creel information was collected about once a week at which time traffic recorders were read. Fisherman interviews were obtained from 94 fishing parties representing 182 anglers. Completed trip information was recorded for 92 percent of the interviews. Anglers caught a total of 1,611 fish of which kokanee comprised 99 percent of the catch (Table 1). Cutthroat trout made up the remaining 1 percent. Seventy-three percent of the anglers caught limits (10 fish daily) of kokanee while 98 percent were successful in catching 1 or more fish. The average catch of all species was 8.85 fish per angler with an average hourly catch of 3.0 fish.

Length frequency measurements were made for 1,403 kokanee. Age analysis was determined by scale readings. The total length of 2-year old kokanee ranged between 8.3 and 10.3 inches. This age group comprised 69 percent of the kokanee catch and averaged 9.5 inches. Three-year old fish ranged between 10.4 and 13.1 inches, averaged 11.0 inches, and comprised 31 percent of the catch. The average weight of 2 and 3-year old kokanee was 0.28 and 0.42 pounds respectively. A length frequency of kokanee measured from the angler harvest is shown in Figure 1.

Table 1. Summary of Lake Mary Ronan winter creel census data, January 4 through March 15, 1989.

Census Day	No. Parties	Anglers	Total Hours Fished	Total Fish Caught	Species			CPA	CPH	Limit Catch (Kok)
					Kok	Wct	Rb			
1/04	4	6	13.0	45	45	0	0	7.5	3.50	1
1/24	8	13	42.5	36	36	0	0	2.8	.93	0
1/27	8	16	30.75	159	159	0	0	9.9	5.2	15
2/13	6	11	27.25	110	110	0	0	10.0	2.50	11
2/21	7	14	28.75	140	139	1	0	10.0	4.9	13
2/27	6	13	51.00	92	92	0	0	7.1	1.8	6
3/08	15	29*	70.25	300	277	23	0	10.3	4.3	25
3/13	12	23	95.75	199	198	1	0	8.7	2.1	15
3/15	12	23**	177.50	530	530	0	0	9.3	3.0	47
Totals/Avg. (9 days)	94	182	536.75	1611	1586	25	0	8.85	3.0	133 (73%)

*Includes Tribal member, caught 18 Wct
 **Included 2 anglers 16 over kokanee limit (10 salmon daily and 20 in possession)

Legend: Kok = kokanee	Wct = westlope cutthroat trout	Rb = rainbow trout
CPA = catch per angler	CPH = catch per hour	

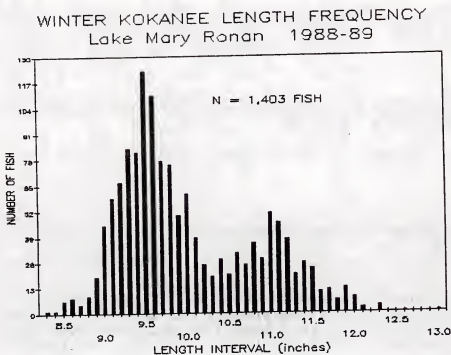


Figure 1. Lake Mary Ronan winter kokanee length frequency, 1987-88.

The total estimated fishing pressure was 8,132 angler days resulting in an estimated harvest of 71,561 fish. Kokanee comprised 99 percent of the harvest, a total of 70,748 fish. Westslope cutthroat trout comprised the remaining 1 percent of the catch, an estimated 813 fish. Total estimated fishing pressure and harvest data are presented in Table 2.

Table 2. Fisherman car counts, fishing pressure, and harvest estimates for State Park and west side access areas of Lake Mary Ronan, winter, 1989.

Month	Interval	Days	State Park		Westside Rd.		Totals	
			No. Cars	No. Anglers	No. Cars	No. Anglers	No.* Anglers	No.** Fish
Jan	04-18	14	608	1180	378	733	1913	16834
	19-24	6	361	700	286	555	1255	11044
	25-27	3	110	213	119	231	444	3907
	28-30	3	249	483	183	355	838	7374
Feb	01-06	7	52	101	8	16	117	1030
	07-13	7	283	249	114	221	770	6776
	14-21	8	253	491	24	47	538	4734
	22-27	6	356	691	83	160	851	7489
Mar	28-08	9	280	543	21	41	584	5139
	09-13	5	273	530	37	72	602	5298
	14-5	2	88	170	26	50	220	1936
TOTALS		70	2913	5651	1279	2481	8132	72561

*Estimated using 1.94, average number of fishermen per party.

**Estimated using 8.8, average catch per angler.

A comparison of winter fishing pressure and harvest estimates from 1985 through 1989 is shown in Table 3. Winter fishing pressure and fish harvest has increased by 41 percent and 68 percent respectively over the season of 1985. In comparison with the 1988 season, the number of anglers and fish harvest exhibited an increase of 55 and 184 percent respectively. This significant increase in fishing pressure and harvest may be related to the collapse of the Flathead Lake kokanee fishery and subsequent closure of its winter salmon season. High catch rates also attracted additional anglers and increased harvest.

Table 3. Comparison of winter fishing pressure and harvest estimates for Lake Mary Ronan. 1985-1989.

Year	No. Anglers	No. Fish	Avg.Catch Per Angler	Avg.Catch Per Hour	Species Composition (Kokanee)	Anglers /Acre	Fish /Acre
1985	5770	42528	6.7	1.7	99	3.8	28.3
1986	3301	19927	6.0	1.6	95	2.2	13.2
1987	5101	25505	4.9	1.2	99	3.4	16.9
1988	5230	25209	4.8	1.2	98	3.5	16.8
1989	8132	71561	8.8	3.0	99	5.4	47.5

Lake Mary Ronan Summer Census

A summer creel census was initiated at Lake Mary Ronan beginning on opening Day (May 20, 1989) and will extend through mid-September. A creel census technician was hired to interview fishermen on all weekend days, holidays, and three weekdays per week. The estimates of year around pressure and harvest will be extremely valuable in updating management strategies to regulate the fishery. As of June 21, 865 angler interviews were recorded resulting in a catch of 2,602 fish. Kokanee comprised 81 percent of the catch, followed by 15 percent westslope cutthroat trout, 3 percent rainbow trout, and 1 percent largemouth bass. The average catch per angler was 3.0 fish and the catch per angler hour was 0.75 fish. a Job Completion Report of both the summer and winter creel census study will be completed in 1990.

Little Bitterroot Lake Winter Creel Census

A winter creel census was conducted at Little Bitterroot Lake for a period of 85 days from January 15 through April 9, 1989. Little bitterroot Lake is located 25 miles west of Kalispell. A total of 276 anglers were interviewed on 14 days during this period. This included information from 115 incomplete and 161 complete trips.

Completed trip information compiled at two-week intervals is presented in Table 4. The total fish harvest from 161 completed trips was 2,805 fish. The average catch per angler was 13.5 fish at a catch rate of 3.6 fish per hour. The average length of trip was 3.8 hours.

Kokanee comprised 99.6 percent of the harvest with rainbow and brook trout comprising the remaining 0.4 percent. Seven of 8 rainbow trout caught were identified as kamloops trout planted in June of 1988. These fish were planted as 8 to 10 inch fish in June of 1988 and averaged 14.1 inches at the time of harvest. Thirteen percent of the kokanee fishermen caught limits of kokanee (50 fish). Daily limits have been liberalized and kamloops introduced in an attempt to reduce densities of kokanee and therefore increase growth rates and average length.

Table 4. Completed angler trip data, collected at two-week intervals for Little Bitterroot Lake, winter 1989.

Two-Week Interval	No. Parties	No. Anglers	No. Hours	Average Length Trip	No. Fish	Catch /Hour	Catch/Angler Day
1/15-1/28	15	33	114	3.5	109	1.0	3.3
1/29-2/11*	0	0	0	0	0	0	0
2/12-2/25	8	13	36.5	2.8	131	3.6	10.1
2/26-3/11	17	45	153	3.4	717	4.7	15.9
3/12-3/25	20	45	177.5	3.9	754	6.4	16.8
3/26-4/09	10	25	129	5.2	472	3.7	18.9
TOTALS	70	161	610	3.8	2183	3.6	13.6

*Extreme cold weather period - angling pressure very low.

The estimated total harvest in the winter of 1989 was 16,250 fish. Kokanee comprised 16,182, rainbow 54, and brook trout 14 fish in the harvest respectively. Total estimated fishing pressure was 6,861 angler hours representing 1,694 angler days.

The catch per angler day increased significantly as the season progressed. The catch per angler day was 6 times greater during the last two weeks of the season as compared to the first two weeks. A similar trend in catch success through the winter season was experienced for Ashley Lake in 1988. The average catch per angler for Little Bitterroot lake was slightly greater (13.6 fish) than that of Ashley Lake (11.5 fish) in 1988.

Total length measurements were collected from 1,148 kokanee caught by fishermen. These fish ranged from 6.3 to 13.5 inches and averaged 8.6 inches. The average length of II+, III+, and IV+ fish as determined by scale readings was 7.2, 8.7, and 11.3 inches respectively. A length frequency distribution of kokanee harvested in Little Bitterroot Lake during the winter of 1989 is presented in Figure 2.

The fishery is utilized primarily by local fishermen. Flathead County residents comprised 92 percent of the angling pressure followed by Lincoln County (5 percent), and Sanders County (3 percent) residents.

WINTER KOKANEE LENGTH FREQUENCY
Little Bitterroot Lake - 1989

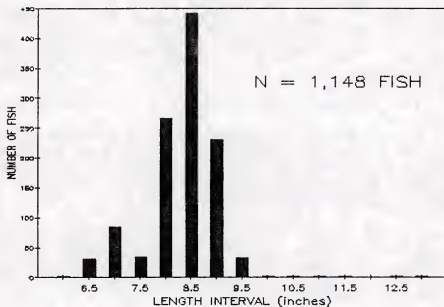


Figure 2. Winter kokanee length frequency, Little Bitterroot Lake, 1988-1989.

Foy Lake Winter Creel Census

A creel census was conducted at Foy Lake during the winter of 1988-89 to determine angling use and fish harvest. Foy Lake is located approximately 5 miles southwest of Kalispell and is utilized almost entirely by local fishermen. The lake is stocked annually with 25,000 4"-6" rainbow (Arlee strain) trout.

The census was initiated on January 7, 1989, and continued through March 25 over a period of 77 days. Angler counts were taken on 35 randomly chosen days at 3-hour intervals on scheduled days, usually 1 weekend day and 2-3 weekdays per week. Angler counts combined with angler interview data (17 days) were used to determine total fishing pressure and angler harvest.

Both winter fishing pressure and fish harvest were extremely low. The estimated total fishing pressure was 1,245 angler days resulting in an estimated harvest of 414 fish. The average catch per angler day was 0.33 fish and the average catch per angler hour was 0.24 fish. The average length of trip was only 1.4 hours. Rainbow trout measurements were taken from 17 fish. The fish averaged 14.5 inches and ranged between 13.0 and 16.1 inches.

The extremely low harvest was probably related to a high winter fish mortality. Low dissolved oxygen readings of less than 3.0 ppm were recorded beneath the ice in late March. It appeared that fish most affected by low oxygen

concentrations were rainbow trout stocked the previous year as 4"-6" fish. Most of the fish recorded in the fisherman's creel were larger fish from previous year's plants.

In 1990 Eagle Lake strain rainbow trout reared in high alkaline waters at the Bluewater State Fish Hatchery will be stocked as 4"-5" fish in September. Barring a repeat of critical oxygen levels experienced in 1989, it is believed this rainbow trout strain will better adapt to high alkalinity (600+ ppm) existing in Foy Lake.

Lake Mary Ronan Gill Net Surveys - Spring and Fall

Annual gill net surveys are conducted in spring and fall to monitor population trends of trout and kokanee. This is an on-going annual monitoring survey conducted since 1965. A total of 6 gill nets (3 floating and 3 sinking nets) are fished overnight for each sampling period. The catch results from fall, 1986 on are presented in Table 5.

The average catch per net night (fall netting) of kokanee (Age I+ and II+) increased from 3.8 in 1987 to 18.7 fish in 1988. Age class I+ fish comprised 78 percent of the catch compared to 21 percent for Age II+ fish. Age I+ fish increased in average length from 8.7 inches in 1987 to 9.0 in 1988 while II+ fish increased from 10.4 to 10.9 inches.

The average catch per net night (spring netting) of kokanee exhibited a decrease from 8.7 fish in 1988 to 5.2 fish in 1989. Age II+ fish comprised 65 percent of the catch, age III+ 22 percent, and age I+ 13 percent. All age groups combined showed slight decreases in growth compared to the spring of 1988. Age I+ fish decreased from 7.1 to 6.6 inches, age II+ 9.8 to 9.5 inches and age III+ 11.7 to 11.1 inches.

The average catch per net night of rainbow trout increased from 1.5 fish in the fall of 1987 to 2.6 fish in 1988. Average spring catch rates increased dramatically from 0.2 fish per net night in 1988 to 2.7 fish in 1989.

The average catch per net night of westslope cutthroat trout in the fall increased from 3.8 fish in 1987 to 5.7 fish in 1988. Eighty-two percent of fish collected in the fall were planted as yearlings (4"-6") in the spring of 1988 and averaged 10.0 inches. Eighteen percent were 1987 plants averaging 12.8 inches. The overall size average of cutthroat trout remained about the same for both spring and fall netting periods. The average catch of cutthroat trout collected in the spring decreased from 3.0 fish per net night in 1988 to 0.8 fish in 1989. The sharp decrease in numbers could have been related to cooler surface water temperatures (56°F) at the time of sampling in 1988.

A comparison of Lake Mary Ronan gill net catch data of kokanee and trout from the fall of 1986 through the spring of 1989 is shown in Table 5.

Table 5. Comparison of Lake Mary Ronan gill net catch data of kokanee and trout for spring and fall netting series, 1986 through 1989. (Mature spawning kokanee not included in fall netting data.)

Species	Fall 1986				Fall 1987				Fall 1988			
	No.	Avg. Catch Per Net	Avg. Standard Lgth Deviation		No.	Avg. Catch Per Net	Avg. Standard Lgth Deviation		No.	Avg. Catch Per Net	Avg. Standard Lgth Deviation	
Kokanee (I+)	86	14.3	7.9	0.45	18	3.0	8.7	0.35	88	14.7	9.0	0.39
Kokanee (II+)	53	8.8	10.9	0.66	5	0.8	10.4	0.34	24	4.0	10.9	0.35
Avg. Combined	139	23.2	9.0	---	23	3.8	9.1	---	58	18.7	9.3	
Rainbow Trout	15	2.5	14.7	3.18	9	1.5	15.3	4.99	16	2.6	13.5	3.52
Westslope Cutthroat Trout	16	2.7	12.1	2.08	23	3.8	10.5	0.66	34	5.7	10.5	1.20

Species	Spring 1987				Spring 1988				Spring 1989			
	No.	Avg. Catch Per Net	Avg. Standard Lgth Deviation		No.	Avg. Catch Per Net	Avg. Standard Lgth Deviation		No.	Avg. Catch Per Net	Avg. Standard Lgth Deviation	
Kokanee (I+)	3	0.5	6.5	0.15	19	3.2	7.1	0.35	4	0.7	6.6	0.32
Kokanee (II+)	9	1.5	9.2	0.33	16	2.7	9.8	0.44	20	3.3	9.5	0.36
Kokanee (III+)	1	1.2	12.2	0.00	17	2.8	11.7	0.54	7	1.2	11.1	0.37
Avg. Combined	13	2.2	8.9	---	52	8.7	9.4	---	31	5.2	9.1	
Rainbow Trout	6	1.0	16.5	2.45	1	0.2	16.0	0.00	16	2.7	16.2	3.00
Westslope Cutthroat Trout	8	1.3	11.7	1.33	18	3.0	11.9	0.50	5	0.8	11.8	1.40

Hungry Horse Gill Net Surveys

Fish Abundance and Distribution

Horizontal Gill Nets. - Westslope cutthroat trout have comprised most of the catch in floating nets throughout the study followed by northern squawfish (Table 6). The catch of cutthroat was highest in the spring and fall while squawfish numbers are highest in the summer net sets. Mountain whitefish have predominated the sinking net catches followed by bull trout, northern squawfish and suckers. A substantial catch of pygmy whitefish was recorded for the first time in fall, 1986. The ripe spawning condition of the fish captured indicated that we had set several nets over their spawning beds. The catch composition of sinking and floating nets has been relatively stable through the years.

Catches of westslope cutthroat trout were relatively stable with no discernible trends except in 1988 when a high catch rate of 6.6 fish per net was recorded. This catch was primarily due to record drawdown levels in 1988 which concentrated the cutthroat thus making them more susceptible to nets. Bull trout catch rates also exhibited a large increase in 1988 but there was not a discernible trend in abundance among the years.

Mountain whitefish have comprised 37 to 40 percent of the sinking net catch from 1983-1988. Catches have varied from 6.8 to 22.3 fish per net. The low reservoir levels in 1988 did not appear to influence catch rates as in other species.

Northern squawfish catches were substantial in both sinking and floating gill nets with the highest catch of up to 10.0 fish per net recorded in the summer. The catches in 1988 tended to be higher than in previous years. Overall there did not appear to be any major changes in abundance from 1983-1988.

Suckers comprised an important part of the catch in sinking nets during the summer but were uncommon in floating nets. The catch in 1988 was higher than in other years due to the deep drawdown concentrating the fish.

Table 6. Average catch of fish species in floating and sinking gill nets from Hungry Horse Reservoir, 1983-1988.

Date	Number of nets	Reservoir Elevation ¹	Catch per net night for areas combined from Hungry Horse Reservoir					
			WCT	DV	MWF	NSQ	CSU	LNSU
<u>Floating Gill Nets</u>								
<u>Spring</u>								
05/84	40	3521	2.4	0.6	0.4	0.7	0.2	0.1
05/85	70	3517	3.5	0.6	0.2	0.7	0.1	0.0
05/86	84	3537	1.9	0.3	0.1	0.3	0.1	0.1
05/87	84	3545	3.2	0.9	0.3	0.8	0.1	0.1
05/88	25	3440	6.6	1.8	0.4	2.2	2.2	0.9
<u>Summer</u>								
08/83	42	3560	0.4	0.1	0.0	2.0	0.1	0.0
08/84	84	3558	0.2	0.1	0.1	4.1	0.1	0.0
08/85	84	3545	0.6	0.1	0.4	1.5	0.1	0.1
08/86	84	3558	0.3	0.1	0.1	3.1	0.1	0.1
08/88	36	3480	0.9	0.2	0.6	5.9	0.4	0.0
<u>Fall</u>								
11/83	42	3536	2.4	0.2	0.6	0.1	0.0	0.0
10/84	54	3540	1.1	0.1	0.3	0.5	0.1	0.0
11/85	68	3525	1.3	0.2	0.2	0.1	0.1	0.0
11/86	84	3530	1.9	0.4	0.1	0.8	0.0	0.0
11/88	42	3468	2.8	0.8	1.4	0.1	0.1	0.0

Table 6 continued.

Table 6. Continued.

Sinking Gill Net

			<u>Spring</u>						
05/84	12	3521	0.4	5.3	6.4	3.9	1.1	3.8	
05/85	25	3517	0.1	4.7	13.1	2.0	1.7	3.1	
05/86	30	3537	0.3	5.8	12.3	2.0	1.8	3.6	
05/87	30	3545	0.4	6.3	8.7	4.4	3.6	8.6	
05/88	9	3440	0.2	9.4	8.1	6.0	6.2	12.2	
			<u>Summer</u>						
08/83	9	3560	0.1	0.8	1.3	8.3	4.1	7.8	
08/84	30	3558	0.1	1.4	3.1	9.1	3.7	6.1	
08/85	30	3545	0.3	2.7	6.1	10.0	2.9	4.6	
08/86	30	3558	0.3	2.2	3.4	7.7	3.4	5.6	
08/88	15	3480	0.5	3.5	7.1	10.0	6.1	4.2	
			<u>Fall</u>						
11/83	9	3536	0.3	2.2	10.0	2.2	0.9	0.1	
10/84	17	3540	0.3	4.4	22.3	4.6	0.8	0.3	
11/85	25	3525	0.2	3.8	6.8	2.3	1.0	0.3	
11/86 ²	30	3530	0.4	4.8	12.8	2.1	1.2	0.1	
11/88	15	3468	0.9	6.9	13.5	3.7	2.5	1.8	

 1 full pool elevation = 3,560 ft. msl.

² 1.2 Pygmy whitefish

 Key: WCT = westslope cutthroat DV = Bull trout
 MWF = mountain whitefish NSQ = northern squawfish
 CSU = coarse scale sucker LNSU = longnose sucker

Lake Monitoring of Kokanee Populations

In 1988, 10 kokanee lakes were sampled to monitor size trends (total length of mature spawning kokanee). The age structure of spawning adults was determined by otolith examination. A summary of the average length and age composition of mature kokanee collected in the fall of 1988 is presented in Table 7.

Table 7. Average length and age structure of spawning kokanee collected from selected lakes in the fall of 1987.

Lake	Surface Acres	No. Fish	Males		No. Fish	Females		Age Structure %		
			Avg. Length Inches	Size-Range Inches		Avg. Length Inches	Size-Range Inches	II+	III+	IV+
Ashley	3244	15	10.6	(9.9-11.1)	26	10.4	(9.7-11.1)	2.5	95	2.5
Bull	1240	1	12.7	----	0	---	----	--	--	--
Crystal	178	33	18.2	(17.7-20.5)	9	17.9	(16.9-19.0)	27	63	10
Glen	340	28	15.5	(14.8-16.9)	69	15.3	(13.2-16.4)	10	45	45
Lake Blaine	372	17	12.1	(11.6-12.6)	5	11.7	(11.0-12.4)	---	---	100
Lake Mary Ronan	1505	25	13.2	(11.5-15.2)	25	13.2	(11.7-14.2)	---	76	24
Middle Thompson	602	11	18.3	(16.6-19.5)	10	17.0	(15.6-17.8)	---	73	27
Spar	392	9	15.5	(14.4-20.2)	6	15.7	(12.3-14.2)	82	9	9
Swan	2680	25	9.4	(9.1-10.2)	25	9.7	(8.8-10.7)	---	80	20
Tally	1326	25	10.1	(9.1-10.7)	10	9.8	(9.5-10.1)	---	93	7

Fish were collected by one of three methods: beach seining, gill nets, and electrofishing. The data collected is used in part to formulate future management strategies, primarily adjustment of stocking numbers and creel limits for individual waters.

Several mature kokanee salmon were observed cruising the shoreline of Foy Lake. These were 2-year old kokanee initially planted as fry in 1986. Attempts to capture fish by electrofishing were unsuccessful. The survival of successive fry plants made in 1987 and 1988 is doubtful because of extremely low dissolved oxygen levels (less than 3.0 ppm) recorded during the winter of 1988-1989. The 1989 kokanee fish plant scheduled for Foy Lake was transferred to Hubbard Reservoir.

Seining and electrofishing efforts to collect kokanee eggs for the statewide hatchery production program were conducted at four lakes. A total of 1,645,000 eggs were taken from Lake Mary Ronan, Swan, Glen, and Ashley lakes. Ninety percent of the total egg take was taken from Lake Mary Ronan and Swan lakes. Continued low water levels at Lake Mary Ronan prevented mature fish from concentrating at traditional spawning areas where beach seining operations are conducted. Consequently, electrofishing gear was utilized to collect scattered schools of fish cruising the shoreline. Egg-take operations at Ashley and Little Bitterroot were relatively unsuccessful.

Mysis Monitoring

In Ashley Lake mysid numbers began to increase substantially from 1985 to 1986 (12.1/m² to 37.0/m²) (Table 8). During 1987 densities more than doubled to a high of 86.3/m for the period 1983-1988. As mysid numbers progressively

Table 8. Average lakewide June Mysis densities (no./m²) for selected lakes.

Lake	Size	No./m ²					
		1983*	1984	1985	1986	1987	1988
Ashley	Juveniles (<10mm)	-0-	4.3	3.8	25.8	70.7	57.3
	Adults (≥10mm)	<u>1.3</u>	<u>8.7</u>	<u>83</u>	<u>1.2</u>	<u>15.6</u>	<u>19.1</u>
	Combined	1.3	13.0	12.1	37.0	86.3	76.4
Little Bitterroot	Juveniles	-0-	8.6	12.7	19.4	8.6	6.4
	Adults	<u>7.3</u>	<u>15.9</u>	<u>9.2</u>	<u>7.0</u>	<u>13.1</u>	<u>8.0</u>
	Combined	7.3	24.5	21.9	26.4	21.7	14.4
McGregor	Juveniles	-0-	8.3	0.6	7.0	15.6	34.7
	Adults	<u>6.1</u>	<u>5.4</u>	<u>3.2</u>	<u>4.8</u>	<u>14.7</u>	<u>28.0</u>
	Combined	6.1	13.7	3.8	11.8	30.3	62.7
Swan	Juveniles	-0-	37.9	69.4	108.9	53.2	73.2
	Adults	<u>20.1</u>	<u>33.1</u>	<u>25.5</u>	<u>142.7</u>	<u>169.4</u>	<u>51.6</u>
	Combined	20.1	71.0	94.9	251.6	222.6	124.8
Whitefish	Juveniles	-0-	67.5	207.0	151.9	52.9	80.9
	Adults	<u>18.5</u>	<u>18.8</u>	<u>22.0</u>	<u>23.9</u>	<u>12.1</u>	<u>10.5</u>
	Combined	18.5	86.3	229.0	175.8	65.0	91.4

*30 meter hauls using a larger mesh net were used in 1983.

Little Bitterroot lake mysid densities remained the most constant of all lakes monitored. When mysid numbers decreased from 21.7/m² to 14.4/m² from 1987 to 1988, cyclops numbers similarly decreased.

Mysid numbers in McGregor Lake have more than doubled each year from 1986 to 1988 (11.8/m² to 30.3/m² to 62.7/m²). During the period, daphnia numbers have decreased and cyclops have maintained a constant low level.

Swan lake mysid numbers were initially low in 1983 and steadily increased to a peak in 1986 of 251.6/m². Densities dropped slightly in 1987 to 222.6/m² and then decreased to 124.8/m² in 1988. Zooplankton response to the mysid changes was not substantial.

Mysis in Whitefish lake peaked during 1985 at 229/m² and declined since then to 91.4/m² in 1988. Daphnia and Bosmina appeared to increase as mysids declined.

Table 9. Mean lakewide zooplankton densities (no./liter) from regional Mysis monitoring lakes during June, 1985-1988.

Lake	Year	Cladocerans			Copepods			
		Daphnia	Bosmina	Total	Epischura	Diaptomus	Cyclops	Total
Ashley	1985	0.6	0.3	0.9	0.5	-0-	8.0	8.5
	1986	1.4	0.7	2.1	-0-	-0-	14.3	14.3
	1987	-0-	21.6	21.6	-0-	-0-	13.7	13.7
	1988	0.6	15.4	16.0	0.1	-0-	19.2	19.3
L.Bitterroot	1985	0.1	0.6	0.7	0.5	-0-	6.0	6.5
	1986	-0-	1.6	1.6	0.2	-0-	10.3	10.5
	1987	0.8	26.5	27.3	0.1	-0-	13.4	13.5
	1988	-0-	5.4	5.4	0.4	-0-	6.1	6.5
Flathead	1985	2.0	0.8	3.7	0.1	25.8	1.8	27.7
	1986	0.1	0.1	0.2	0.1	13.0	0.8	13.9
	1987	0.1	-0-	0.1	0.9	3.1	0.4	4.4
	1988	-----N/A-----						
McGregor	1985	4.4	0.1	4.5	0.2	0.2	0.1	0.5
	1986	3.5	-0-	3.5	0.2	-0-	-0-	0.2
	1987	1.7	0.1	1.8	-0-	0.1	-0-	0.1
	1988	1.1	0.1	1.2	-0-	-0-	-0-	-0-
Swan	1985	-0-	-0-	-0-	0.1	5.2	1.0	6.1
	1986	-0-	-0-	-0-	9.3	1.4	0.9	2.6
	1987	-0-	0.4	0.4	2.3	8.2	-0-	10.5
	1988	0.1	0.8	0.9	1.2	4.7	2.8	8.7
Whitefish	1985	0.4	0.3	0.7	0.1	-0-	11.0	11.1
	1986	3.3	1.5	4.9	-0-	-0-	11.4	11.4
	1987	3.6	5.7	9.3	5.9	0.1	-0-	6.0
	1988	3.2	3.5	6.7	-0-	-0-	18.1	18.1

RECOMMENDATIONS

1. Continue monitoring winter fishing pressure at Lake Mary Ronan by monitoring traffic counter data at the state park and west shore access.
2. Discontinue annual Mysis monitoring on the five lakes. Intensify monitoring on Ashley and Little Bitterroot lakes to document mysid/kokanee interactions. Monitoring would include: seasonal kokanee food habits, kokanee age and growth, and seasonal zooplankton and Mysis densities for food availability index.
3. Continue monitoring kokanee populations in 16 kokanee lakes every 1-4 years on a scheduled basis to evaluate changes in fish populations due to changes in fish regulations, stocking rates, and spawning conditions.
4. Special Trout Regulation Lakes: initiate creel census in 1990 during the summer months to determine fisherman use, catch rates, and average size of angler catch. Also included should be an angler attitude survey to measure acceptance of special regulation lakes. These lakes include No Tellum, Spencer, Bootjack, and Woods.

5. Small Lake Surveys:

- a. Renovate Banana Lake with rotenone to remove nongamefish and manage as a stocked lake for rainbow or cutthroat trout using state funding. (Refer to small lake surveys F-46-R-1.)
- b. Renovate Topless Lake with rotenone to eliminate nongame species (pumpkinseed and bull heads) and restock with cutthroat trout using state funding. (Refer to small lake surveys F-46-R-1.)
- c. Survey 5-10 lakes each year to update management recommendations.

LITERATURE CITED

McFarland, Bob and Ric Roche, 1987. Montana Fish Wildlife & Parks User Manual for the Creel Census Program running on an IBM PC Compatible Microcomputer, March 2, 1987.

Rumsey, Scott, 1988. Mysis monitoring in western Montana lakes, 1983-1987, Supplement F-7-R-37, I-a.

Prepared by: Robert Domrose
Date: July 11, 1989

Waters referred to:

Ashley Lake (07-5220-03)	Banana Lake (11-7852-04)
Bootjack Lake (11-7980-03)	Bull Lake (11-8040-03)
Crystal Lake (11-8180-03)	Foy Lake (07-6420-03)
Glen Lake (11-8380-03)	Holland Lake (07-6780-03)
Hubbart Reservoir (07-6840-95)	Hungry Horse Resv. (08-8860-05)
Lake Blaine (07-5380-03)	Lake Mary Ronan Lake (07-7700-03)
Lindbergh Lake (07-7260-03)	Little Bitterroot Lake (07-7300-05)
Lower Thompson Lake (05-9152-03)	Middle Thompson Lake (05-9232-03)
No Tellum Lake (07-8128-05)	Noxon Rapids Reservoir (05-9328-05)
Spar Lake (11-9640-03)	Swan Lake (07-9000-05)
Tally Lake (7-9060-03)	Topless Lake (11-9830-03)
Woods Lake (07-9580-03)	

Key Words: Cyclops, Daphnia, Bosmina, kokanee, rainbow, Mysis

Fish species referred to:

brook trout - <u>Salvelinus fontinalis</u>
bull trout - <u>Salvelinus confluentus</u>
kokanee - <u>Oncorhynchus nerka</u>
largescale sucker - <u>Catostomus macrocheilus</u>
longnose sucker - <u>Catostomus catostomus</u>
mountain whitefish - <u>Prosopium williamsoni</u>
pygmy whitefish - <u>Prosopium coulteri</u>
rainbow trout - <u>Oncorhynchus mykiss</u>
squawfish - <u>Ptychocheilus oregonensis</u>
westslope cutthroat trout - <u>Salmo clarki lewisi</u>

